SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 5
APPLIED PHYSICS COURSE CODE : US05CAPH21 (4 Credit Course)
COURSE TITLE : Quantum and Statistical Mechanics
(Effective from June 2020)

UNIT 1: Origin of quantum mechanics:

Particle aspects of radiation: Blackbody radiation, photoelectric effect, Compton Effect, Wave aspects of particles: de Broglie's hypothesis, particle versus waves: classical views of particle and waves, Quantum view of particle and waves, wave particle duality. Heisenberg's Uncertainty principle, Rutherford planetary model of the atom, Bohr model of the Hydrogen Atom, Energy level of hydrogen atom, spectroscopy of Hydrogen atom, phase velocity and group velocity.

UNIT 2:

Photons: the quantization of fields A free particle in one dimension, Generalization to three dimensions, The operator correspondence and the Schrodinger equation for a particle subject to forces, Normalization and Probability interpretation, Non-normalizable wave functions and Box normalization, Conservation of probability, Expectation values, Ehrenfest's theorem, Admissibility conditions on the wave function, Stationary states: the time independent Schrodinger equation, A particle in a square well potential.

UNIT-3 Statistical Mechanics-I

Basic concept of statistical mechanics, Phase space, Ensemble, Grand canonical, canonical and micro canonical ensemble, Density of states, partition function, internal energy, entropy, MB statistics: Introduction, distribution of gas molecules (KE and velocity), applications, limitation, Illustrative examples.

Unit-IV Statistical Mechanics-II

Bose Einstein statistics: Introduction, derivation of distribution law, derivation of Plank's law of radiation, Bose Einstein condensate.
Fermi Dirac statistics: Introduction, derivation of distribution law, Application: specific heat of metals comparison: Maxwell Boltzmann, Bose Einstein, and Fermi Dirac statistics. Illustrative examples.

Text Books:

1. Quantum mechanics concepts and applications by Nouredine Zettili, Wiley Publications (2^{nd} Edition)
2. Fundamentals of Quantum Mechanics by Mathews and Venktesan

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 5
APPLIED PHYSICS COURSE CODE : US05CAPH22 (4 Credit Course)
COURSE TITLE : Mathematical Methods
(Effective from June 2020)

UNIT – 1 : Linear Equations : Vectors, Matrices and Determinants

Introduction to linear equations, Sets of linear equations, Row reduction, Determinants : Evaluating determinants, useful facts about determinants, Cramer's rule, Vectors : Notation, magnitude of a vector, addition of vectors, vectors in terms of components, multiplication of vectors, scalar product, angle between two vectors, perpendicular and parallel vectors, vector product, Lines and planes, Matrix operations, Matrix equations, transpose of a matrix, multiplication of matrix by a number, addition of matrices, multiplication of matrices, application of matrix multiplication

UNIT – 2 : Multiple Integrals : Applications of Integration

Introduction, double and triple integrals, Iterated integrals, Applications of integration : single and multiple integrals, change of variables in integrals : Jacobians, spherical and cylindrical coordinates, Jacobians, surface integrals

UNIT – 3 : Fourier Series

Simple harmonic motion and wave motion: periodic functions, applications of Fourier series, average value of a function, Fourier coefficients, Dirichlet conditions, complex form of Fourier series, even and odd functions, an application to sound

UNIT – 4 : Partial differential equations

Introduction, Laplace's equation : steady-state temperature in a rectangular plate, the diffusion or heat flow equation : heat flow in a bar or slab, the wave equation: the vibrating string, vibration of a circular membrane, Poisson's equation.

Text Books:

1. Mathematical methods in the physical sciences, Mary L. Boas, John Wiley and Sons
2. Mathematical methods in Physics, D. Biswas, New Central Book Agency (P) Ltd., Kolkata

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 5
APPLIED PHYSICS COURSE CODE : US05CAPH23 (4 Credit Course)
COURSE TITLE : Solid State Physics
(Effective from June 2020)

UNIT-1: Crystallography:

Introduction, Lattice points and space lattice, The basics and crystal structure, Unit Cell, Unit Cell versus Primitive Cell, Unit Cell and lattice parameters, Crystal types, Two dimensional crystal lattice, Seven crystal system, Symmetry Operations (Translational, Point, & Hybrid), Metallic and common crystal structures, Relation between the density of crystal materials and lattice constants, Directions planes and Miller Indices of crystal planes, important features of Miller indices in a cubic crystal, separation between lattice planes in cubic crystal.

UNIT 2: Cohesion of atoms and cohesive energy:

Introduction, Force between atoms, Cohesion of atoms and cohesive energy, Calculation of cohesive energy, Calculation of lattice energy of ionic crystals, Calculation of Madelung constant of ionic crystals, The Born–Haber cycle, Bonding in solids, Primary Bonds (Covalent, Metallic, Ionic and Mixed), Secondary bonds (van der Waals and Hydrogen Bond), Properties of primary and secondary bonds, Wave mechanical concept of atom, Atomic size, Ionic radii, Empirical ionic radii, variation of ionic radii, Covalent radii, Metallic radii, van der Waals radii.

UNIT 3: Free electron theory of metals:

Introduction of free electron gas, the Drude-Lorentz theory, electrical conductivity of metals, thermal conductivity of metals, Lorentz modifications to Drude model, the Sommerfeld Model, the Fermi-Dirac distribution function, Quantum theory of free electrons in a box, free electron concentration, Number of electrons per energy interval at 0K, properties of a degenerate fermi gas at T>0K, electrical conductivity and Ohm's law, electronic specific heat, thermionic emission, escapes of electron from a metal.

UNIT 4: Band theory of solids:

Introduction of band theory; Density of states; k-space; bloch wave; Bloch theorem; Kronig penney model; origin of energy gap; Brillouin Zones; number of possible wave functions per band; velocity of electrons according to band theory; influence of electric field; distinction between metals, insulators, and intrinsic semiconductors; direct experimental evidence for band structure.

Text Books:

1. Fundamentals of solid state physics by Saxena, Gupta, saxena, Pragati prakashan, Meerut
2. Solid state physics R. K. Puri, V. K. Babbar (S. Chand publication)
3. Introduction of solid state physics (8th edition) Charles Kittel (John wiley and sons).

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 5
APPLIED PHYSICS COURSE CODE : US05CAPH24 (4 Credit Course)
COURSE TITLE : Concepts of Applied Physics and Control Systems
(Effective from June 2020)

UNIT – 1 : Biophysics

Introduction, Energies, forces and bonds: Inter atomic potentials for strong bonds and weak bonds, Non-central forces, Bond energies. Rates of reaction: Free energy, internal energy, Thermodynamics and statistical mechanics, Reaction kinetics, Water acids, bases and aqueous reactions. Radiation energy, Transport processes: Diffusion, Viscosity and conduction. Biological Polymers: Nucleic Acids. Nucleic Acids conformation: DNA and RNA. Proteins, Biological membranes: Historical background, Membrane chemistry and structure. Biological energy: Energy consumption, Respiration and photosynthesis. Movement of organism: Bacterial motion, Chemical memory in primitive organisms. Muscular movements.

UNIT 2 : Non-Destructive Testing(NDT)

Introduction: The objective of non-destructive testing, types of defects, methods, methods of non-destructive testing, liquid penetrant, dye penetrant, radiographic, X-ray radiography, X-ray fluoroscopy, electrical current testing, ultrasonic inspection method, magnetic particle inspection, pulse echo system, visual display units, other nondestructive inspection techniques (optical inspection probes, time of flight diffraction, thermography, surface texture analysis.

UNIT – 3 : Unit 3 Basic Control System

Discontinuous control system, ON-OFF control system, multi-position control system, continuous control system, proportional control system, integral control system, derivative control system, proportional-integral control system, proportional-derivative control system, proportional-integral-derivative control system, Block diagram representation of process control systems, components of process control system, sensor and transmitters, transfer function of control system, open-loop control system, closed-loop control system, feedforward control system, cascade control system, ratio control system, analog and digital control system, linear and non-linear control systems.

Unit – 4 : SCADA and PLC

Supervisory control and data acquisition systems (SCADA), channel scanning, data processing, distributed SCADA system, remote terminal unit, input module, output module, communication modules, software facilities, introduction to microcomputers, programmable controllers, programmable logic controllers (PLC), PLC architecture, basic structure, PLC programming, ladder diagram, PLC communication and networking, PLC selection, PLC installation, advantages of using PLCs.

Text Books

1. Bio physics, an introduction by Rodney Cotterill. John wiley and sons
2. Fundamental concept in bio physics (Vol.-1) Thomas Jue Springer.
3. Biological Physics: energy, information, life. By Philip Nelson
4. Elementary Biophysics an introduction by P K Shrivstava
5. Process control instrumentation by Curtis Johnson
6. Industrial instrumentation and control by S. K. Singh
7. Non-destructive testing by Barry Hull, Vernon John (Macmillan education)

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 5
APPLIED PHYSICS COURSE CODE : US05CAPH25 (4 Credits, 8 hrs per week)
COURSE TITLE : PRACTICALS
(Effective from June 2020)

Text Books:

3.

Reference Books:

1.

SARDAR PATEL UNIVERSITY
SYLLABUS FOR APPLIED PHYSICS
B. Sc. SEMESTER – 5
APPLIED PHYSICS COURSE CODE : US05DAPH26 (2 Credit Course)
COURSE TITLE : 8085 Microprocessor Architecture, Programming, and Applications
(Effective from June 2020)

Unit 1 Microprocessor-based systems: hardware and interfacing

A microprocessors as a programmable device, organization of microprocessor based system, machine language, assembly language, operating systems, microprocessor-controlled temperature system (MCTS), the 8085 hardware and programming model, instruction classification, instruction, data format and storage, microprocessor architecture and its operations, input and output devices, review devices for interfacing (tri-state device, buffer, decoder, encoder)

Unit 2 8085 microprocessor architecture and instructions

The 8085 microprocessor, demultiplexing the bus AD7-AD0, generating control signals, a detailed look at the 8085 MPU and its architecture, opcode fetch machine cycle, OUT instruction, IN instruction, data transfer operations, addressing modes, arithmetic operations, logic operations, branch operations

Unit 3 Programming techniques with additional instructions

Programming techniques: looping, counting and indexing, additional data transfer and 16-bit arithmetic instructions, arithmetic operations related to memory, logic operations rotate, logic operations compare, dynamic debugging, counters and time delays, time delay using one register, time delay using register pair, time delay using loop within loop technique

Unit 4 Counter, time delays, interrupts and DMA

Hexadecimal counter, modulo ten counter, generating pulse waveforms, stack, subroutine, restart, conditional call and return instructions, advanced subroutine concepts, operating systems, tools for developing assembly language programs (editor, assembler, loader, debugger), cross-assembler, 8085 interrupts, 8085 vectored interrupts, direct memory access

Text Books

1. Microprocessor architecture, programming and applications by Ramesh S. Gaonkar
2. Understanding 8085/8086 microprocessor and peripheral ICs through questions and answers by S. K. Sen